

THE CLAIMS

What is claimed is:

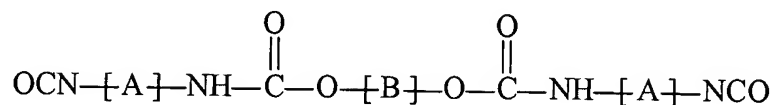
1. A golf ball comprising:

a core having a compression greater than about 55; and

an outer cover comprising an acid-functional polyurethane, polyurea, or copolymer thereof, the outer cover having a Shore D hardness of at least about 25, a thickness of from at least about 0.02 inches to about 0.03 inches, and a specific gravity of at least about 0.7.

2. The golf ball of claim 1, wherein the acid-functional polyurethane or polyurea is formed from an acid-functional prepolymer comprising at least one of an acid-functional polyol, an acid-functional oligomer, or an acid-functional organic amine; and at least one of an isocyanate or an acid-functional isocyanate.

3. The golf ball of claim 2, wherein the acid-functional polyol or an acid-functional organic amine have the formula:



where A = a straight chain or branched aliphatic or alicyclic group, a substituted straight chain or branched aliphatic or alicyclic group, or an aromatic or substituted aromatic group; and B = R-Y, where R = a straight chain or branched aliphatic or alicyclic group, a substituted straight chain or branched aliphatic or alicyclic group, or an aromatic or substituted aromatic group, and Y = HSO₃, HCO₂, or H₂PO₃.

4. The golf ball of claim 2, wherein the acid-functional polyol or acid-functional oligomer comprise carboxylated, sulfonated or phosphonated derivatives of polyester polyol; polyether polyol; polylactone polyol; polytetramethylene ether glycol; poly(oxypropylene)glycol; polybutadiene glycol; polyethylene adipate glycol;

polyethylene propylene adipate glycol; polybutylene adipate glycol; diethylene glycol initiated caprolactone; 1,4-butanediol initiated caprolactone; trimethylol propane initiated caprolactone; neopentyl glycol initiated caprolactone; oligomers of dimethylol propionic acid, or oligomers of isophthalic sulfonic acid.

5

5. The golf ball of claim 2, wherein the acid-functional polyol or acid-functional oligomer has an acid number of from about 10 to about 150, a hydroxyl number of from about 10 to about 175, or a hydroxyl functionality of at least about 1.8.

10 6. The golf ball of claim 2, wherein the acid-functional prepolymer has an isocyanate content of from about 2% to about 32% and the equivalent weight ratio of isocyanate to curing agent is about 0.80 to about 1.20.

15 7. The golf ball of claim 2, wherein the isocyanate comprises 4,4'-diphenylmethane diisocyanate; 3,3'-dimethyl-4,4'-biphenylene diisocyanate; toluene diisocyanate; polymeric diphenylmethane diisocyanate; modified liquid 4,4'-diphenylmethane diisocyanate; hexamethylene-diisocyanate; 4,4'-dicyclohexylmethane diisocyanate; isophorone diisocyanate; *m*-tetramethylxylene diisocyanate; *p*-tetramethylxylene diisocyanate; *p*-phenylene diisocyanate; *m*-phenylene diisocyanate; or low-free
20 isocyanate.

8. The golf ball of claim 2, wherein the acid-functional polyurethane or polyurea further comprises a curing agent.

25 9. The golf ball of claim 8, wherein the curing agent comprises an amine curing agent, a glycol curing agent, or a mixture thereof.

10. The golf ball of claim 9, wherein the curing agent is an amine curing agent comprising 4,4'-bis-(sec-butylamino)-dicyclohexylmethane; 1,4-bis-(sec-butylamino)-cyclohexane;
30 3,5-dimethylthio-2,4 (2,6)-toluenediamine; 3,5-diethyl-2,4 (2,6)-toluenediamine; N,N'-dialkyldiamine diphenyl methane; trimethylene-glycol-di-p-aminobenzoate; or

polytetramethyleneoxide-di-*p*-aminobenzoate with molecular weight ranging from about 250 to about 1000.

11. The golf ball of claim 9, wherein the curing agent is a glycol curing agent comprising ethylene glycol; diethylene glycol; propylene glycol; 1,3-propane glycol; 1,4-butanediol; 1,5-pentanediol; 1,6-hexanediol; or polytetramethylene ether glycol with molecular weight ranging from about 250 to about 1000.

12. The golf ball of claim 2, wherein the acid-functional isocyanate comprises carboxylated, sulfonated or phosphonated derivatives of diphenylmethane-2,4'-diisocyanate; diphenylmethane-4,4'-diisocyanate; 3,3'-dimethyl-4,4'-biphenylene diisocyanate; 2,4-toluene diisocyanate; methylenebis-(4-cyclohexyl diisocyanate); phenylene-1,4-diisocyanate; diphenyl ether 4,4'-diisocyanate; naphthylene-1,5,-diisocyanate; *p*-phenylene diisocyanate; *p,p'*-diphenyl diisocyanate; hexahydrophenylene-1,3-diisocyanate; hexahydrophenylene-1,4-diisocyanate; triphenylmethane-4,4',4''-triisocyanate; perhydrodiphenylmethane-2,4'-diisocyanate; perhydrodiphenylmethane-4,4'-diisocyanate; ethylene diisocyanate; propylene-1,2- diisocyanate; tetramethylene-1,4-diisocyanate; hexamethylene-1,6-diisocyanate; dodecane-1,12-diisocyanate; dicyclohexylmethane diisocyanate; cyclobutane-1,3-diisocyanate; cyclohexane-1,3-diisocyanate; cyclohexane-1,4-diisocyanate; 1-isocyanato-3,3,5-trimethyl-5-isocyanatomethylcyclohexane; or 1,3-xylene diisocyanate.

13. The golf ball of claim 2, wherein the acid-functional organic amine comprises carboxylated, sulfonated or phosphonated derivatives of polyolamines; polymethylene-di-*p*-aminobenzoates; polyethyleneglycol-bis(4-aminobenzoates); polydimethylsiloxane-bis(4-aminobenzoates); polytetramethyleneetherglycol-di-*p*-aminobenzoates; polypropyleneglycol-di-*p*-aminobenzoates; N,N,N',N'-tetramethyl-ethylenediamine; 1,4-diazobicyclo(2,2,2)-octane; N-methyl-N'-dimethylaminoethylpiperazine; N,N-dimethylbenzylamine; bis-(N,N-diethylaminoethyl)-adipate; N,N-diethylbenzylamine; pentamethyldiethylenetriamine; N,N-dimethylcyclohexylamine; N,N,N',N'-tetramethyl-

1,3-butanediamine; N,N-dimethyl-.beta.-phenylethylamine; 1,2-dimethylimidazole; or 2-methylimidazole.

14. The golf ball of claim 2, wherein the prepolymer further comprises a co-polymer polyol
5 comprising polytetramethylene ether glycol; poly(oxypropylene) glycol; poly(ethylene
oxide capped oxypropylene) glycol; diethylene glycol initiated polycaprolactone;
propylene glycol initiated polycaprolactone; 1,4-butanediol initiated polycaprolactone;
trimethylol propane initiated polycaprolactone; neopentyl glycol initiated
10 polycaprolactone; 1,5-pentanediol initiated polycaprolactone; 1,6-hexanediol initiated
polycaprolactone; polytetramethylene ether glycol initiated polycaprolactone;
polyethylene adipate glycol; polyethylene propylene adipate glycol; polybutylene adipate
glycol; ortho-phthalate-1,6-hexanediol polyester polyol; polyethylene terephthalate
polyester polyol; poly(hexamethylene adipate) glycol; poly(phthalate carbonate) glycol;
15 poly(hexamethylene carbonate) glycol; polycarbonate glycols containing bisphenol A;
hydroxy-terminated polybutadiene glycol; hydroxy-terminated liquid isoprene rubber;
acrylic polyol; or *p*-dimer alcohols converted from dimerized fatty acids.
15. The golf ball of claim 1, further comprising an intermediate layer disposed between the
20 core and the cover.
16. The golf ball of claim 15, wherein the intermediate layer has a thickness of between
about 0.02 inches and about 0.035 inches.
17. The golf ball of claim 1, wherein the acid-functional polyurethane or polyurea comprises
25 a thermoset or thermoplastic material.
18. The golf ball of claim 1, wherein the acid-functional polyurethane, polyurea, or
copolymer thereof is fully-neutralized with an organic or an inorganic base moiety.
- 30 19. A golf ball comprising:
a core;

an outer cover comprising an acid-functional polyurethane, polyurea, or copolymer thereof, the cover layer having a Shore D hardness of at least about 25 and a thickness of from at least about 0.02 inches to about 0.03 inches; and

an intermediate layer disposed between the core and the outer cover, the intermediate layer comprising an acid-functional polyurethane, polyurea, or copolymer thereof, the intermediate layer having a thickness of from at least about 0.02 inches to about 0.035 inches.

20. A golf ball comprising:

a core;

an outer cover comprising an acid-functional polyurethane, polyurea, or copolymer thereof, the cover layer having a Shore D hardness of at least about 25, a specific gravity of at least about 0.7, and a thickness of from at least about 0.02 inches to about 0.03 inches; and

an intermediate layer disposed between the core and the outer cover, the intermediate layer comprising a blend of an acid-functional polyurethane, polyurea, or copolymer thereof and at least one of non-anionic polyurethanes, epoxy resins, polyethylenes, polyamides, polyesters, acid copolymers or their ionomer derivatives, or mixtures thereof.